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# Logistic and Economic system of Central Asia

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**Annotation:** The globalization of the world economy and the internationalization of business open up the possibility for most enterprises to search for more optimal sources of supply for production and marketing of their products. Today, many enterprises have enough resources and opportunities to organize and carry out transportation, not only in the domestic market, but also in the external one, using transit mechanisms. Taking into account global trends, companies are not limited only by the capabilities of the region of presence and national borders, but are constantly looking for new opportunities to cover the planned need for resources and the ability to meet the growing demand in foreign markets. In this regard, the design of global supply chains is inextricably linked with the movement of traffic flows and the implementation of related transport tasks[1].

**Key words:** globalization, internationalization, global trends, global supply chains, traffic flows

## Introduction

Logistics takes on a global scale, provided that the supply chain crosses the borders of one or more states. As part of global supply chains, traffic flows move from supplier companies to the focus company, crossing the boundaries of its home base, and after processing them into a finished product, they are redirected to the final consumer, and, depending on the number of chain links, also cross the borders of one or several states.

As part of the transport support of global supply chains, the leading role is played by the process of studying routing and international traffic flows, which is a progressive and highly efficient way of organizing the transport process and can significantly reduce the time, distance and cost of cargo delivery, as well as ensure the stability of global supply chains with minimal losses[2].

The organization of cargo transportation implies laying the route of movement, standardizing the processes of loading, unloading, transshipment, as well as documentary escort of goods. The process of establishing interaction between the participants of the organized global supply chain is also of high importance[3].

Building a traffic flow diagram within global supply chains includes several interrelated stages: analysis of the performance of various modes of transport, determination of the volume of deliveries and their dynamics, determination of the loading and unloading capabilities of the transport infrastructure, mapping of consignees and key objects of cargo transshipment and loading works; distance analysis of all possible delivery routes; choice of rolling stock and traffic patterns of vehicles.

Rational choice of route is associated with the optimal selection of delivery vehicles. Using the possibilities of various combinations of vehicles makes it possible to compensate for the shortcomings of one mode of transport with the advantages of another. The use of different modes of transport in routing depends on a number of factors: general and specific.

General factors include: the geographical location of production and consumers, determine the volume and direction of traffic flows; dimensions of cargo units, determine the type of vehicle and the frequency of flights; the cycle of production and the size of stocks, set the delivery time for the laid routes. In turn, specific transport factors include:

[1] Vladimirov S. A. On the main directions of development of the world transport system and Logistics // Bulletin of Transport Information - 2016. - No. 1. - P. 13-19.
[2] Nazarenko V. M. International activities to improve transport ensuring foreign economic relations: a textbook for students / Nazarenko V. M. -publishing house M: MGIMO, 2016 - 152 p.
[3] Nikolaeva M.Yu. The role of transport in the logistics chain // Bulletin of young scientists Samara State University of Economics - 2015. - No. 2. - P. 216.

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- geographical location of communication routes and infrastructure facilities;
- working conditions, seasonality of shipments and frequency of flights; throughput of means of communication and infrastructure facilities on the route; technical equipment;
- development of freight forwarding service[4].

The specificity of the transport support of global supply chains is due to the large distances of transportation and the increasingly complex structure of routes. It is also worth noting the influence of individual modes of transport on the process of designing and functioning of global supply chains, which often make significant adjustments in connection with new trends in the development of the international transportation industry.

**Literature review**

This section analyses relationship between value chain trade and logistics based on results of the research. Nexus amongst logistics, transport infrastructure and trade has been widely studied by colossal number of scientific (Limao and Venables, 2001) and policy (Arvis et al., 2012) research papers. Countries` international trade heavily relies on their transport infrastructure, since advanced transport infrastructure fosters regional and international competitiveness of countries. Furthermore, importance of logistics is crucial for linking together various transport systems and developing international value chains ( Bensassi et al., 2015). Therefore, studying the link between transport systems and international trade is highly relevant (Li and Qi, 2016).

Performance in logistics is rapidly being acknowledged as "one of the critical pillars for development" (Arvis et al., 2014). Ineffective logistics increases trading and integration expenses, while efficient logistics helps a nation's economy to be incorporated in global value chains (GVCs) and fosters growth (Bensassi et al., 2015). Physical movement of products has now become extremely important as production continues to divide across geographical areas. Integrating of all international commercial activities in MNEs' GVCs is thus one of the primary problems from the viewpoint of MNEs (Gereffi and Lee, 2012). The logistics networks that link the multiple areas of the value chain are crucial to the successful integration of a GVC's features (Onsel Ekici et al, 2016; Memedovic et al., 2008). Our research results illustrated in tables in 5.6 and 5.13 in line with aforementioned research outcomes. Development of logistics infrastructure in the regions positively effecting on value chain trade of the region. Although having such kind of progress in their logistics structure the region having challenges to be solved.

**Analysis and discussions**

Taking into account CA as a landlocked region, we should emphasize that its international trade turnover carried through land and air transport systems. In order to deliver their local products into final destination, CA economies have to transit different countries. This leads to increase in transportation costs and period of arrival of the goods. Rail and road transport systems provides fundamental support for international shipment in bulk and in containers, linking central Asian economies with international markets. To date, contribution of rail transport in the transportation service varies from 60 percent in Kazakhstan, up to 80-90 percent in Uzbekistan and Tajikistan (Rastogi and Arvis 2014). After the break up, Central Asian countries inherited from Former Soviet Union, the task of reconstructing and developing infrastructure of existing railroads and highways. Researches prove that transition of transport systems into modern modes is not complete, since the countries are still struggling with high trade costs and low logistics performances (see table-1). CA countries ranked at lowest LPI index compared to other Asian countries, which means the economies have a lot to do in order to provide high participation at GVC.

[4] Larin O. N. Prospects for the integration of transport systems of the Eurasian Economic Union // Problems of National Strategy - 2017. - No. 4. - P. 152-170.

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**Table-1**
**Aggregate LPI ranking and scores CA and other Asian economies 2012–18**

| | Mean ran | Mean LPI score, | % of highest performer |
|---|---|---|---|
| Kyrgyz Republic | 132 | 2.38 | 57 |
| Kazakhstan | 77 | 2.77 | 66.2 |
| Uzbekistan | 117 | 2.5 | 59.7 |
| Turkmenistan | 142 | 2.34 | 55.8 |
| China | 27 | 3.6 | 86.1 |
| Malaysia | 35 | 3.34 | 79.9 |
| Philippines | 64 | 2.91 | 69.6 |

*Source: The Logistics Performance Index and Its Indicators World Bank*

In the region Kazakhstan and Uzbekistan have the longest rail lines, those rail lines connects the region to Europe and Asia. Table- indicates that Kazakhstan and Uzbekistan lengthened and improved the quality of internal rail lines. The developments on region`s transport infrastructure is highly related to "Belt and Road" initiation. Even though, China`s projects on building East–West corridors aim multiple goals such as finding new markets, securing resource proficiency, economical dominance, project related countries having great advantage from Chinese investments including CA region. For instance, On the basis of Chinese OFDI Kuryk port, and new ferry terminal in Aktau were build and launched in 2016, Borzhakty-Ersay railway line, 14 kilometres-long, constructed to connect Kazakhstan`s railway system to the port[5], additionally Kazakhstan put about 600 km of highways into use between Khorgos and Almaty, Astana and Temirtau in 2017.[6]

**Table-2**
**Length of CA countries` Rail lines (total route-km)**

| | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|---|---|---|
| Kazakhstan | 14202 | 14184 | 14319 | 14767.1 | 14767.1 | 14767.1 | 15529.8 |
| Kyrgyz Republic | 417 | 417 | 417 | 417 | 417 | 424 | 424 |
| Tajikistan | 621 | 621 | 621 | 621 | 621 | 597 | 597 |
| Turkmenistan* | 3115 | 3115 | 3115 | 3115 | 3115 | 3115 | 3115 |
| Uzbekistan | 4227 | 4258 | 4192 | 4192 | 4192 | 4238 | 4304 |

*Source: Internation Union of Railways (UIC)*

China–Central Asia–West Asia– economic corridor constructed as a branch of New Eurasia Land Bridge Economic Corridor. Construction of this economic corridor fostered enhancement of transportation system of CA economies. Besides, it plays crucial role to increase value chain trade between China and CA countries. Most of the freight transits through Khorgos on the border with Kazakhstan heads to Europe, another branch of rail line is intended to link Kashgar western China with Osh in Kyrgyzstan, at the Irkishtam border passing through Uzbekistan, Turkmenistan, Iran, and Turkey to Europe.[7] It can be seen that CA region became land bridge for transporting Chinese products, into Eupean markets.

[5] "Kazakhstan ne gotov k rostu ob"emov konteinernykh perevozok iz Kitaia," *RzhD-Partner.ru*, June 16, 2017, http://www.rzd-partner.ru/logistics/news/kazakhstan-ne-gotov-k-rostu-obemov-konteynernykh-perevozok-iz-kitaya/.

[6] Zhanbolat Mamyshev, "Kazakhstan i Rossiia ispol'zuiut do 5 protsentov ot chisla vzaimnykh aviiareisov," *Atameken Business Channel*, February 14, 2017, http://www.abctv.kz/ru/news/kazahstan-i-rossiya-ispolzuyut-do-5-ot-chisla-vzaimnyh-avia.

[7] Tristan Kenderdine, "Kitai ispytyvaet trudnosti so svoim krupneishim proektom v Tsentral'noi Azii," *INOSMI.RU*, May 5, 2017, http://inosmi.ru/politic/20170505/239290874.html.

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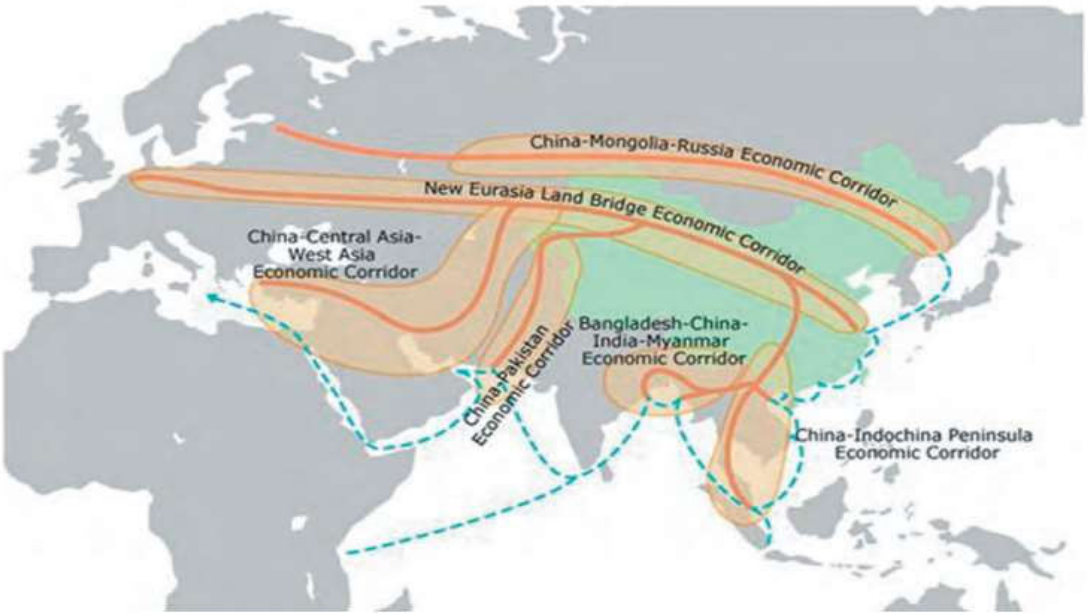
China-Mongolia-Russia Economic Corridor
New Eurasia Land Bridge Economic Corridor
China-Central Asia-West Asia Economic Corridor
China-Pakistan Economic Corridor
Bangladesh-China-India-Myanmar Economic Corridor
China-Indochina Peninsula Economic Corridor

*Source: "Chinese Spending Lures Countries to its Belt and Road Initiative," Bloomberg News, May 10, 2017, https://www.bloomberg.com/graphics/2017-china-belt-and-road-initiative/*

Moreover having a pivotal role in the transportation services, the region`s logistic system is considered as costly and time consuming. Since most of the traders interviewed about encountering delays of their products due to unprecise transit schedule, sometimes up to two weeks, and paying high transportation payments. Carrying 20 tons of cargo through the region for each 500 km costs 700$-1750$, which makes up 40-70 percent of the cost. Additionally, Aforementioned issues in the transportation systems disrupts region`s participation on global supply chains by causing low reliability on their services (Arvis 2010). Additionally, it takes 12 hours on average for a truck to cross borders of CA countries, confessedly this number considerably longer than in other regions of Asia. Therefore, this time-consuming border crossing leads to increase transportation costs by 50 percent. Even road freight charges are highly effected by other variable costs including fuel prices, transport utilisation, contribution of fuel costs pretty higher in Central Asia than other Asian regions (30-35percent).

Besides road freight costs, there is another issue, which takes years to be eliminated, on railway transportation system in the region, it is stated that China, Turkey and Iran use standard rail gauge like most European countries (1,435 metres), in contrast most post-soviet countries and Mongolia use former soviet style broader one (1,520 metres). Indisputably, aforementioned issue creates extra costs, since railway freight have to be reloaded another platform on every border crossing[8].

## Conclusion

Trade possibilities will not be completely utilized and potential profits through commerce will not be developed, according to Prowse (2006), unless action is taken to expand supply capacity, lower transportation costs, enable cross-border mobility of goods, link producers to markets, and so on. If CA countries put their hands on the desk to develop performance of their logistic system, that would not only enhance their trade turnover, but would also discover region`s untapped potential on international trade.

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# The use of new pedagogical Technologies on the topic of the political map of the world of socio-economic geography lessons

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**Annotation:** It is known that the organization of classes in interactive methods plays an important role in the development of such features as the memorization of information in students and young people, thinking, taking their position in relation to what is happening around them, and the effective use of the internet. This article will talk about the use of new pedagogical Tehnologies on the topic of the political map of the world of socio-economic geography lessons.

**Keywords:** lesson, educator, cognition, explanation, Application, Analysis, generalization (synthesis), assessment.

## Introduction

Lesson-is the main organizational form of school education, considered sacred.

A lesson is a didactic event that is organized in a strict order with a certain amount of constant student content and is aimed at acquiring knowledge for a specific purpose.

The lesson form of Education has been used since a long period in Turkestan, a former Soviet colony. During that period, attention was paid not only to the external aspects of Turkestan schools, but also to the essence of the lesson.

Pedagogue – derived from the Greek word, means Peda – “child”, gog - “leading”, that is, “leading the child in his path.” This word appeared in ancient Greece.

The emerging XXI century today is the information age. This requires both practical and theoretical inextricable connection of lesson lessons. And from the teacher, the lesson requires the search for new methods, new pedagogical Tehnologies.

## Literature Analysis And Methodology

Uzbekistan, Russia and other state educational system since the 90s of the XX century, such concepts as "new pedagogical technologies", "advanced pedagogical technologies", "educational technologies", "school Technologies", "Information Technologies" and others have entered.

By the 20th century, in connection with the high level of development of Science Technology, a number of problems have arisen in the education system. Such problems include the design and implementation of educational technologies, where the receipt of results is established from the very beginning. To this end, in the 50-70s of the XX century in the USA at B. Blum. D. Kratvoll, N. Gronlund, Dj.Carol.DjBlok, A. Anderson and other scientists guarantee to obtain the results planned bygon, reproducinggon technologies that involve the pedagogical cycle have been developed. These technologies began to be used in Europe. Scientific research on pedagogical Technologies has been published.

Pedagogical technologies in Russia in the 1990s of the 20th century were predicted to spread. In the fake of these technologies B. P. Bespalko, M. V. Klarin, V. G. Guzeev, T. S. Nazarov. N. D. Nikondova, N. F. Kastenka, V. R. Imakova, G. Ilni, B. I. Bulin, Sokolova, Yu.G. Molokova, O. P. K. Episheva and others began to be seen in the magazine "if".Shkolnie technologii carried out tremendous workdiyu Selevko

New pedagogical technologies were supported in primary education (preschool education, primary, secondary, special and Higher Education). In the field of pedagogical technologies in Uzbekistan since 2000, primary scientific works and teaching aids have been published. In this Sakha B. P. Farberman, N.

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Seydakhmedov, F. Jumabaev, A. Ochilov, L. Golish, B. Ziyamuhamedov, SH.Abdullaev, J. O. Tolipova, A. T. Gafurov and others did great work. At the moment, the legal name "educational technologies" has been published at the Tashkent Pedagogical University named after Nizami. On the development of pedagogical and Information Technology Teaching and geographical educational technologies in geography education I. V. Doshina, V. T. Dmitreva, A. N. Varabev, A. A. Ushakova, N. V. Novenko, I. I. Barina, A. A. Bakhchieva, U. X. Safarov, X. Nikadamboyevd and others are working.

Admission to higher educational institutions in Uzbekistan since 1992 is carried out on the basis of pedagogical tests. Pedagogical technologies and the quality of education were opened at the Institute of higher and secondary special school problems. In geography education, reading technologies are supported by advanced, some are now supported. I. V. Dushina (2004) is used in geography education, thegon technologies are divided into the following types: logical tayorch technology of synopsis; technology of shaping methods of educational work; technology of teaching activities of students; comunicative-Communication Technology; Technology of student design activities.

Currently, information on the scientific and methodological foundations of pedagogy and information technology support in geography education. Geography definition of educational goals. The goals and objectives of geography education are developed and presented in the existing educational standards. By standards, educational goals and objectives are developed for each subject of geography.

The main pointers of geography education are B. Can be represented by taxonomic associations of the Blum or. In this area of problem, there is currently no noticeable work in geography education. [1]

American psychologist scientists R. Garnikau and F. according to macelro studies, the natural physiological and psychological capabilities of the individual make it possible to preserve the knowledge acquired in certain forms to varying degrees. That is, a student or student;

When reading the textbook itself – 10 %

-20 when you hear information from friends %

What happened, when I saw the case and the process-30 %

What happened and when you saw the process and heard information about them-50 %

Information (information) when self-sharing (speaking, demonstrating knowledge) - 80 %

When applying the acquired knowledge(information, information)to its activities - 90% of the volume of information can be kept in mind. Obviously, now systematic work is underway to ensure the continuity of practical classes with theoretical ones. It technologies are being introduced into the industry. [2]

**Discussion And Results**

One of the important aspects of understanding pedagogical Tehnologies is the following:

1) orientation towards very well defined goals;

2) the teaching of students is carried out through the activities of students.

When developing a taxonomy of the goals of geography education, the general goals and objectives of the science of socio-economic geography of the world, a mandatory indication of the content of this education, as well as all the requirements for the level of training of students-young people who graduate from the course are taken into account.

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**Taxonomy of educational goals of the science of socio-economic geography of the world (B.Based on Blum taxonomy)**

| № | The main types of goals on the topic of the political map of the world | Definition of types for which the subject's goals are calculated |
|---|---|---|
| **1** | Know.<br>This tour consists of remembering and telling basic knowledge on the subject of the political map of the world. The word here can range from one of the content of specific geographical facts to the whole theory(hypothesis). The main feature of this category is the ability to remember the relevant information on the topic. | Knowledge of the theoretical foundations of the topic.<br>Knowledge of research techniques on the topic of the political map of the world, and their classification. Knowledge of the material and spiritual expression of the perception of the universe through knowledge of phenomena and processes on the political map of the world knowledge of the structure of the political –gegraphic description of the territory. |
| **2** | **Explanation.**<br>The pointers of this category are as follows: transformation of socio-economic geographical data from one form to another (for example, mapping the territory of states): presentation of information by students-young people or the future political status of events to make proposals (for example, the development of states, their status on the political map, etc.).k) the explanation (political geographic and political law and laws, information, political event and processes) is superior to the simple recall of such. | **Being able to show geographical objects.**<br>Being able to identify(measure) political geographical events and events, as well as objects, be able to interpret political geographic data, describe information on the political map of the world. To be able to explain socio-economic geographical events and events, laws, theories. Prediction of political map change**.** |
| **3** | **Apply.**<br>Application of geographical techniques, general concepts, rules in the mazus of the political map of the world. This includes; rule, Style, Concept, hypothesis and political regularities. The results of relevant education require a higher level of knowledge in relation to the explanation of knowledge. | **Being able to apply political geographic theory and teachings:**<br>Political map of the world, political geographic location, State, UN (United Nations), largest and “dwarf " states, island states, peninsular states, inland continental states, independent states |
| **4** | **Analysis.**<br>Students should be able to: determine how many sovereign states exist, whose independence is officially recognized by the world community, determine the consistency in the changes in the political map of the world, be able to analyze politically, analyze the political map of the holistic world. | **Analysis of the political map of the world**<br>From the point of view of its geographical position on the political map of the world, first of all, the analysis of states that have access to the sea and do not have such an opportunity. |

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| | | |
|---|---|---|
| **5** | **Generalization (synthesis)**<br>Creation of a holistic geographic unit based on the analysis of the data provided. For example, States, from the point of view of their geographical place, are divided, first of all, into states that have access to the sea and do not have such an opportunity. Among the countries with access to the Sea, Island, peninsula and Sea continental states are distinguished.<br>Island states include Indonesia, Phillipin, Japan, Sri Lanka<br>The peninsular states include Saudi Arabia, Spain, Italy, Norway, the Republic of Korea<br>And the seaside continental states are located in the main part of the continents, and the countries with access to the sea are: France, Germany, Poland, China, Egypt, the United States, etc.k S enter. | **Preparation of written work on the basis of an analysis of the data in the Carita of the political map of the world.**<br>Development of an action plan for solving a geographical problem in relation to colonial and aggressive states.<br>Creation of a holistic image of a holistic natural geographic and economic geographic or political card based on private data. |
| **6** | **Evaluation**<br>Evaluation of data and techniques taking into account the existing accepted educational goals. For example, methodological, hydrological, observation of states on the political map of the World, assessment of cartographic, comparative-geographical mathematical techniques.<br>This category requires an assessment of the educational results based on the dimensions in which it is clearly expressed that the results are obtained according to the above categories. | Assessment of a particular state on the political map of the world on the basis of internal data.<br>Having access to the sea on the political map of the world, there is no such possibility, to evaluate the island, Peninsula and seaside continental states in relation to each other or neighboring countries. |

**Conclusion**

In conclusion, I would like to say that the use of new pedagogical Tehnologies on the topic of the world's political map of the world's socio-economic geography lessons primarily affects educational value, that is, the increased interest of students in development; in the second scale, from which each geography teacher teaches a lesson, thirdly, effective, that is,,

Fourth, each teacher can use it, relying on his own experience, taking into account local conditions.

**Used Literature**

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# Applying Geographic information system (GIS) for (Covid-19) epidemic monitoring in Al-Muthanna Governorate

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**Abstract:** Using GIS can assist in collecting data and displaying them to provide a complete picture about the state of disease from pandemic to epidemic. The GIS technique can, specially, help to find solutions to stop diseases and determine fast and accurately the populations exposed and expected to be infected by the contagious and endemic diseases. Mapping the disease spreading among the groups exposed to the risks and the services date can help planners determine where they can increase the precautions and medical activities immediately, as it can help in tracking of the outbreak, so that the planners could recognize the infected areas and restrict them. It also can assist in foreseeing a specific pandemic, follow and observe virus movements while spreading, specify the source of diseases and how these diseases vary from a place to another and deal with the emergencies, and, finally, diagnose and control disease vector through developing a database to those areas.

In this study, the spatial analysis techniques, with their different patterns, have been used in GIS such as spatial distribution functions: measure the average or the central feature of the phenomenon to determine and analyze the geographical distribution photograph of Covid-19 in Al-Muthanna Governorate according to the administrative units. The study shows that using the GIS technique is of high potentials in determining the areas where there are Corona virus outbreaks. Through applying the link neighboring technology, it is obvious that the pattern of Covid-19 distribution is dispersed and geometrically unorganized (close to be random) and does not submit to a particular system with less than 95% significance level in Al-Muthanna administrative units.

Also, through using GIS in measuring the directional distribution, it appears that the directional distribution of infections in the administrative units is related to the directional distribution of the population and the urbanization (Urban growth) which were witnessed by Al-Muthanna administrative units in the mentioned directions. It is indicated, though applying the standard distance scale, that there are administrative units with high numbers of Covid-19 cases, whereas others are not.

**Keywords:** Corona Virus (Covid-19); Geographic Information System (GIS); the Spatial Distribution; Nearest Neighbor; Standard Distance; Al-Muthanna Governorate.

## 1 Introduction

Corona virus, or as it called Covid-19, is considered as one of the infectious diseases which lately has been classified as a pandemic of the present time. This virus is one of the most fast and dangerous among the common viruses in terms of infection on human life. The virus can spread from an infected person's mouth or nose in small liquid particles when they cough, sneeze, speak, sing or breathe. You can be infected by breathing in the virus if you are close to someone who has Covid-19, or by touching a contaminated surface and then your eyes, nose or mouth. In this research , the spatial aspects of individuals are investigated and how the crowded places can influence the virus spreading.

Coronaviruses represent a large family of viruses, which may cause illness in animals or humans. In humans, several coronaviruses are known to cause respiratory infections ranging from the common cold to more severe diseases such as Middle East Respiratory Syndrome (MERS) and Severe Acute Respiratory Syndrome (SARS)[8]. The most recently discovered coronavirus causes coronavirus disease COVID-19. Some people become infected but do not develop any symptoms and do not feel unwell. Most people (about 80%) recover from the disease without needing special treatment. Around 1 out of every 6 people who get

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COVID-19 becomes seriously ill and develops difficulty of breathing. Older people, and those with underlying medical problems like high blood pressure, heart problems or diabetes, are more likely to develop serious illness. People with fever, cough and difficulty breathing should seek medical attention[2].

So, this study aims to detect the incidence of Covid-19 spread in Al-Muthanna Province during 2020.

**2 Concepts and Terminology:**

**1. Coronavirus disease (COVID-19)** is an infectious disease caused by the coronavirus which first identified in Hubei, Wuhan, China[17]. This disease was never known before, and it has been named coronavirus disease 2019 (COVID-19) – 'CO' stands for corona, 'VI' for virus, and 'D' for disease. Formerly, this disease was referred to as '2019 novel coronavirus' or '2019-nCoV, because it was discovered at the end of December 2019 and first called Chinese pneumonia or Wuhan pneumonia. Covid-19 was officially named by the World Health Organization (WHO)[7].

Corona viruses of human are sensitive to the ultraviolet radiation and heat, and they can live for years in C°60[19] . But, with the heat getting higher, the viruses get weaker and die if they are exposed to C°56 for 30 minutes. These viruses cannot live in acids and alkalis, and the best environment for them to reproduce is (7.2) PH[13].

**2. Pandemic:**

COVID-19 was characterized as a pandemic in March 11$^{th}$ of 2020 by WHO, and in the 25$^{th}$ of March 2020, the UN announced that Covid-19 might threaten humankind[10].

The word Pandemic : is an epidemic of an infectious disease that has spread across a large region, for instance multiple continents or worldwide, this means that Covid-19 is a pandemic of a new factor that causes disease, and it spreads easily from one to another among the world. A widespread endemic disease with a stable number of infected people is not a pandemic[9], HIV, H1N1, and Covid-19 were classified as pandemics .

**3. Epidemic**:

The cases of the patients can be characterized as pandemic or epidemic according to the extent of spreading. Outbreak is a sharp increase in the number of people infected with one disease, epidemic is a sharp increase or rise in the number of the infected people witch continue increasing for a large area[14].

**3 Kinds of Corona Virus:**

There are seven variants of corona that infect the human beings:

**1. Corona virus (E229 or HCOV229E).**

E229 is one of the infectious viruses, which can infect humans and bats, (HvoC-229E) stands for this kind. It is surrounded by (membrane) and it is anode (positive) and has Ribonucleic Acid (ssRNA).

**2. Coronavirus ocy3 or HCOV-ocy3.**

**3. Coronavirus NL 63 or HCOV-NL63.**

**4. Coronavirus HKU1 or HCOV-HKU1.** The HCov-HKU1 is one of the most prominent coronaviruses, which were originated from the infected rats. The symptoms appeared on the infected people range from respiratory disease with colds symptoms. The virus was first discovered in January 2005, then the later researches detected that this kind had a wide spreading and earlier existence.

5. **Coronavirus linked to severe acute respiratory syndrome or SARS-COV.** In 2003, and after SARS outbreaks, which started in Asia, and the secondary cases in other places of the world, WHO released a statement reporting that a new Corona virus had been detected in several labs and this one was a pathogenic factor in SARS. It was officially named SARS Corona virus (SARS-CoV), 8000 people were infected and about 10% of them died[16].

6. **Coronavirus linked to Middle East** respiratory syndrome (MERS-CoV) on September 2012, a new kind of Corona virus was identified and named Corona 2012 first, and then this name was changed into MERS-CoV.

**7. New 2019 Coronavirus or (nCov-2019 as it was called previously).** In December 2019, viral pneumonia outbreak was reported in Wuhan, China. In 31$^{st}$ December 2019, this outbreak was linked to a new variant of Coronaviruses, which was officially named nCov-2019 by WHO. As it was reported that

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HcoV-229, NL63[4], OC43 and HKU1 of Coronaviruses spread constantly causing a respiratory infection among adults and children across the globe.

**4 Research Problem:**

1. What is the pattern of Covid-19 distribution in Al-Muthanna Province? and are there certain reasons caused this pattern to dominate in the distribution?
2. What is the capability of GIS in recognizing the present pattern of the spatial distribution of Covid-19 and representing it in maps and charts?
3. How dispersed or concentrated is Covid-19 in Al Muthanna Province from its Mediterranean center and what is the direction of the spatial distribution ?

**5 Research Method:** the descriptive and analytical methods were followed because they depend on studying the phenomenon as it is on the ground, to answer the question set in the research problem and detect the spatial relations in the phenomenon elements and link them spatially to clarity and analysis, and to prove how far the assumption of the research is achieved. These approaches were also adopted to determine the track and the direction of the virus spreading through using figures and maps as a means to recruit these data for its temporal and spatial analysis. The spatial analysis method has been used through applying the suitable analysis function provided by GIS to identify the spatial variations of the virus positions, to find an explanation and analysis for these spatial variations.

The research importance: the research importance appears in having the advantages of GIS applications which help to identify the areas where there is high prevalence rate of the epidemic, as the relevant parties are enable to take the necessary measures to contain the outbreak and vaccinate people in the infected areas so that the outbreak could be ceased.

**6 The spatial and temporal boundaries:**

The area of the study is Al-Muthanna province. The spatial boundaries are represented in South-West border of the Middle Euphrates territory. It is bordered on its North by Al-Qādisiyyah, East by Di Qar, West by Al-Najaf, and the South –southwest by Saudi Arabia. As shown in (Figure. 1). It extends between latitudes 29° 4 11'-31 43.49" N and longitude 43° 48' 23-46 40 19" E. It has 5 districts with 7 sub-districts, the districts are Al-Samawa, Al-Rumaitha, Al-Khudhir, Al-Salman and Uruk, the size of their areas varies.

**7 Research objectives:**

The present study aims at the following:

1. To know the benefits of GIS in studying the status of Covid-19 distribution in Al-Muthanna.
2. To recognize the patterns of Covid-19 the current geographical distribution and represent it in figures and charts.
3. To prepare a suggested geographical database that contains the infected areas.
4. To follow the spatial diseases in public health.
5. To show the activity of GIS in assisting the decision makers.
6. To show GIS ability in applying the methodology of Covid-19 spatial analysis in Al-Muthanna in terms of the administrative units through using the spatial analysis tools.
7. To set proper suggestions and recommendations for the decision makers to take under consideration.

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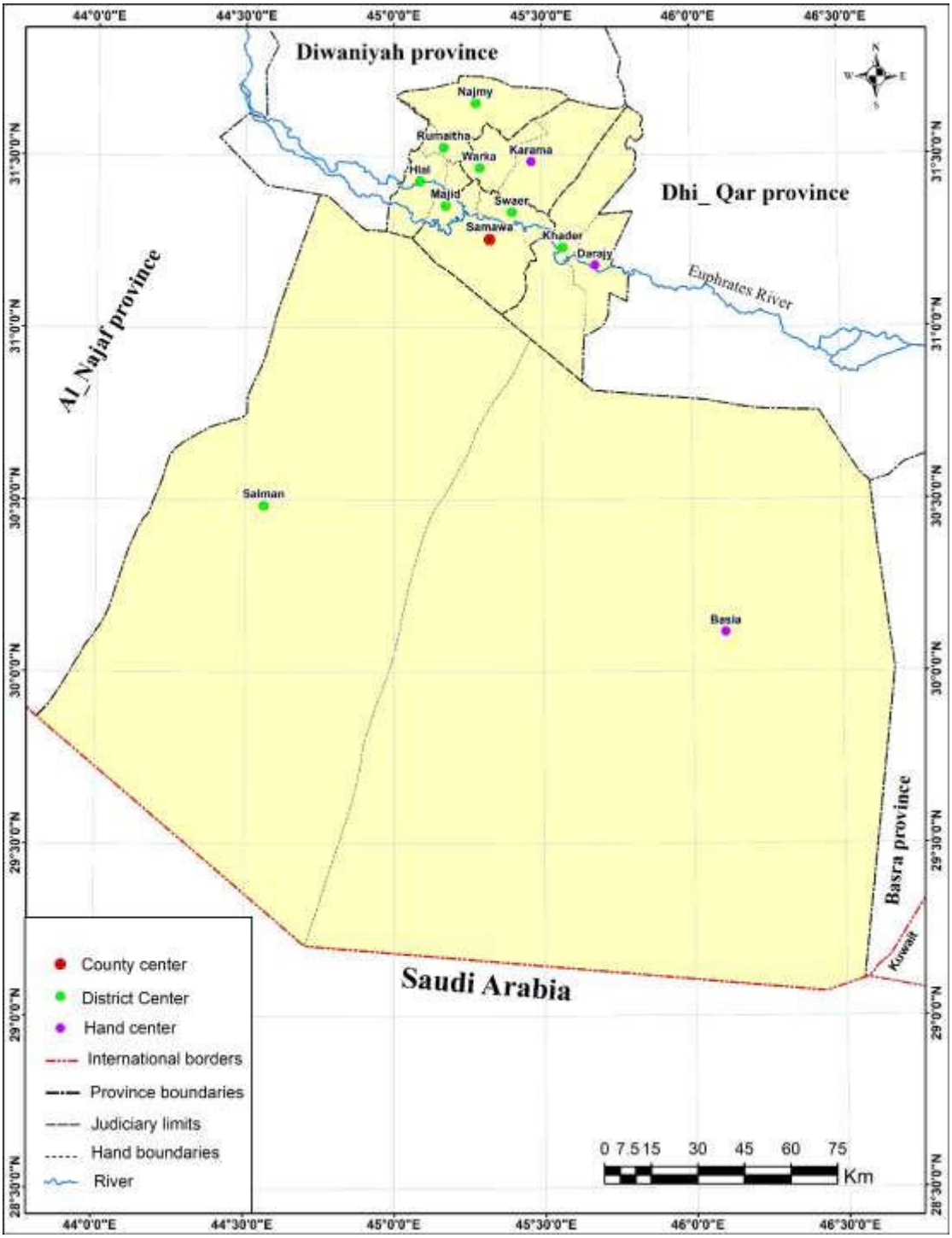


**Figure1: Map Al-Muthanna Administrative Units 2020**

## 8 Variation of disease prevalence in the province:

Talking about Covid-19 prevalence in Al-Muthanna 2020 according to the administrative units, (Table1) and (Figure. 2) show the great variation in the volume and intensity of the disease cases reported and provided by the records of the administrative units of hospitals in Al-Muthanna province, and from the Vital & Health Statistics Section in the Public Health Directorate. The variation of Covid-19 cases prevalence among the regional centers and the sub-district administrative units are as follows: In Al-Salman district, the outbreak rates reached the primacy (277.9) per 10.000 people. In addition, in Uruk district, it reached (51.3) per 10.000 people. In Al-Samawah, Rumaitha, Khudhir, and the sub-district Busayyah, it reached more than two-thirds of Covid-19 prevalence (80.6, 160.5, and 162.8) in a row, per 10.000 people. This is due to what these centers have of medical services, with regard to Al-Salman district. The high

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prevalence is due to the failure in presenting the essential services, in particular the medical ones, as there is no general hospital nor specialized one that could present medical aid in Al-Salman nor in Busayyah. This is what makes local people go where they think that there is a good medical services in closer regions, Al-Samawah and Khudhir.

**Table 1: Covid-19 prevalence 2020 in Al-Muthanna in terms of the administrative units**

| Administrative Unit | Cases[22] | Cases/10000 |
|---|---|---|
| Al-Samawah | 5150 | 162.8 |
| Rumaitha | 2075 | 160.5 |
| Khudhir | 949 | 80.6 |
| Uruk | 540 | 51.3 |
| Al-Salman | 324 | 277.9 |

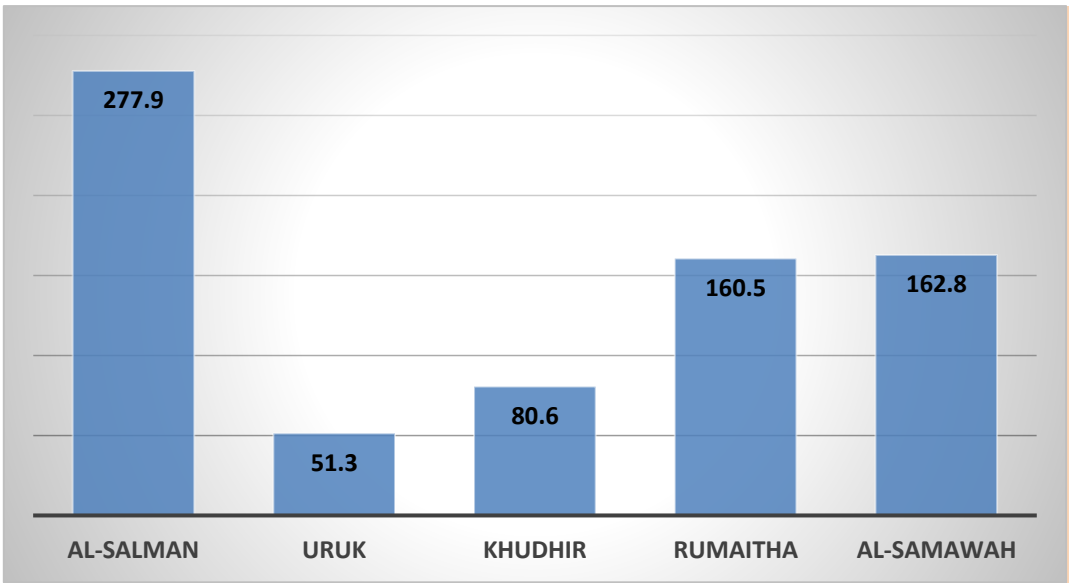


**Figure 2: rates of Covid-19 in Al-Muthanna in terms of the administrative units 2020**

Source: Table (1) data.

**9 The Qualitative Composition of the Infected People:**

This means that the infected people are classified into males and females. Diseases can infect both sexes without exception and in various degrees that are different depending on the disease pattern in the province. (Figure. 3) shows relative infection differences between males and females. The statistics revealed the truth that males are infected more than females as the recorded cases of males reached 4469 64% rate of the overall infections[3] , whereas female cases reached 2469 35.9% . This difference in infection is because males contact with the pathogens more than others. The anatomical structure of males and the functional competencies that may affect the degrees of resistance and immunity, and because of movements and mingle among males more than females as it is the nature of Al-Muthanna community which tends to restrict women`s behavior and participation in work[12].

**Table 2: The Qualitative Composition of Covid-19 infected people in Al-Muthana for 2020**

| Male | % | Female] | % |
|---|---|---|---|
| 4469 | 64 | 2469 | 35.9 |

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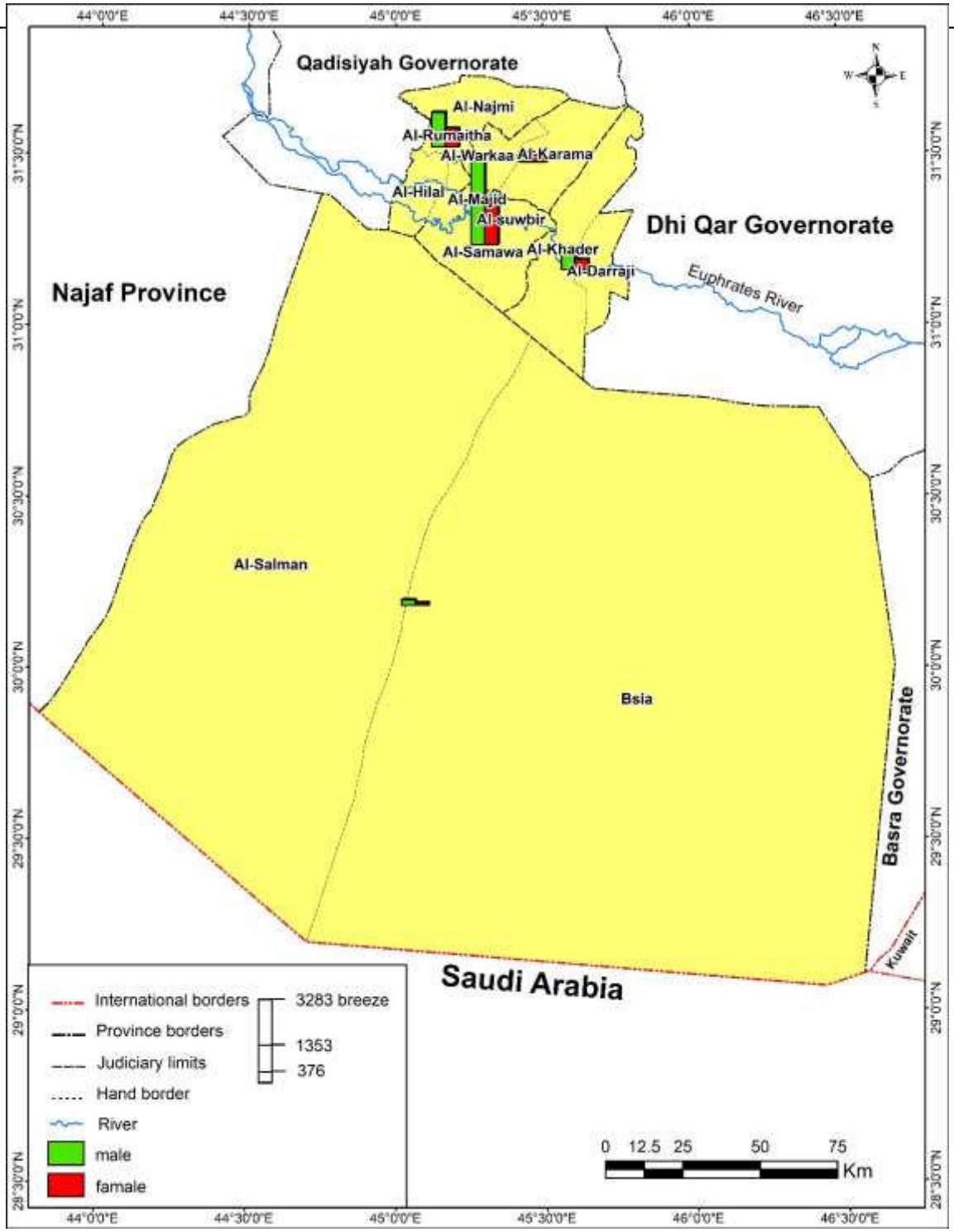


**Figure 3: Map The Qualitative Composition of Covid-19 infected people in Al-Muthana for 2020**
**(**Source: Adopted from Arc GIS10.6 and the data of Table 2)

**10 Age Structure:**

Age structure of infected people refers to the process of distributing them according to their ages. (Figure. 4) and (Table 3) show that the numbers of Covid-19 cases among the age group (22-40) are the highest comparing to the rest, as this age group reached 5465 cases which represent 60.4% and came first in the number of cases . This is due to the idea they have about being immune, but this is unconfirmed truth. Besides that, the tough economic environment where they live so they have to break curfew and keep working. On the other hand, the age group (45-64) came second with 2210 cases representing 24.4%, as they are living with chronic illnesses so they are more vulnerable to be infected than others. The age group (65) came third having (575) cases with 6.3% because they are of weak immune systems and low oxygen levels.

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The (15-19) age group was in the fourth place with (403) cases 4.4% and the other age group (10-14) reached 204 cases, which compose 2.2% of the overall infections. So, this one got the fifth place since they have a healthy respiratory system and they normally do not suffer from any illness in their bodies before. The 6th group is (5-9) age group which recorded (109) cases, rating 1.3% of the overall cases. Children of (1-4) ages reached 54, 0.5% in the 7th place because they have healthy immune systems with increasing white blood cells. The last rank is the group age (infants) recorded 18 cases rating 0.2%.

**Table 3: Age Structure of Covid-19 infected people 2020 in Al-Muthanna governorate**[22]

| Less than a year | 1-4 year | 5-9 year | 10-14 year | 15-19 year | 20-44 year | 45-64 year | Over 65 year | Total |
|---|---|---|---|---|---|---|---|---|
| 18 | 54 | 109 | 204 | 403 | 5465 | 2210 | 575 | 9038 |
| 0.2% | 0.5% | 1.3% | 2.2% | 4.4% | 60.4% | 24.4% | 6.3% | |

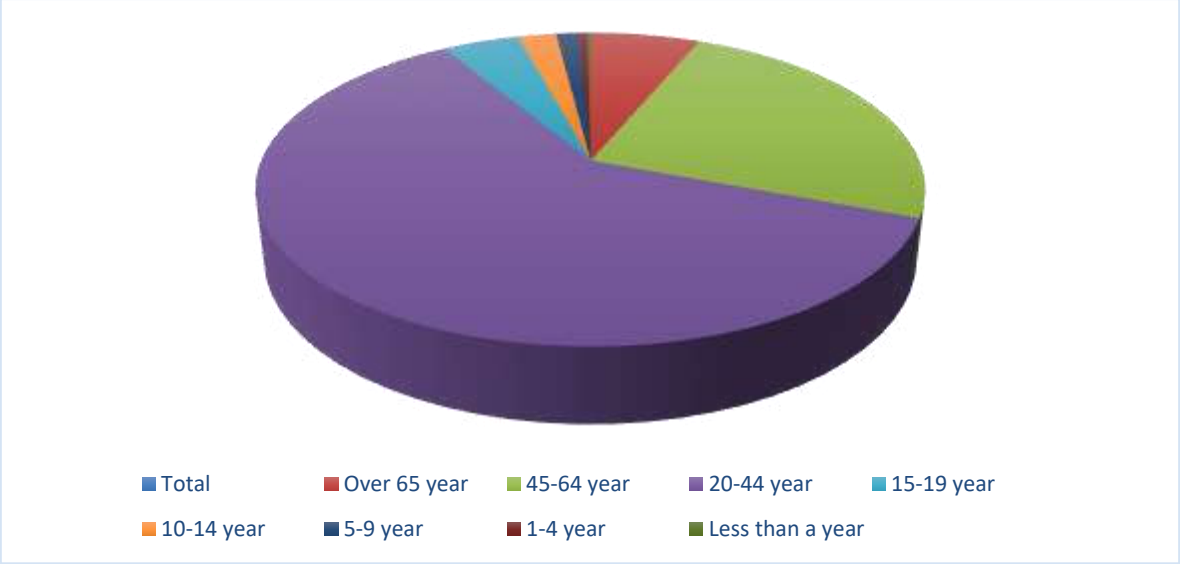


**Figure 4: Age Structure of Covid-19 infected people 2020 in Al-Muthanna Governorate**

Source: Table (3)

**11 Geographic information system analysis (GIS):**

The methods and tools of spatial Analysis in GIS are used, particularly the functions of measuring the geographical distribution, including the phenomenon average measure or Central Feature, Average Nearest Neighbor, Directional Distribution, and Standard Distance.

**11.1 Spatial Distribution of Covid-19**

(Table 4) and (Figure. 5) show that the Covid-19 cases in Al-Muthanna (2020) were distributed to twelve administrative units. The overall spatial distribution of Covid-19 in terms of administrative units indicates that the center of Al-Samawah was in the top among the rest of units with (56.9%), whereas (Uruk and Al-Salman) had the least rate (3.5%, 5.9%) respectively.

**Table 4: relative Spatial Distribution of Covid-19 in Al-Muthanna (2020) in terms of administrative units.**

| Administrative Unit | 2020 | % |
|---|---|---|
| Al-Samawah | 5150 | 56.9 |
| Rumaitha | 2075 | 22.9 |
| Khudhir | 949 | 10.5 |
| Uruk | 540 | 5.9 |
| Al-Salman | 324 | 3.5 |
| Total | 9038 | 100 |

Source: Adopted from the data of Table (1)

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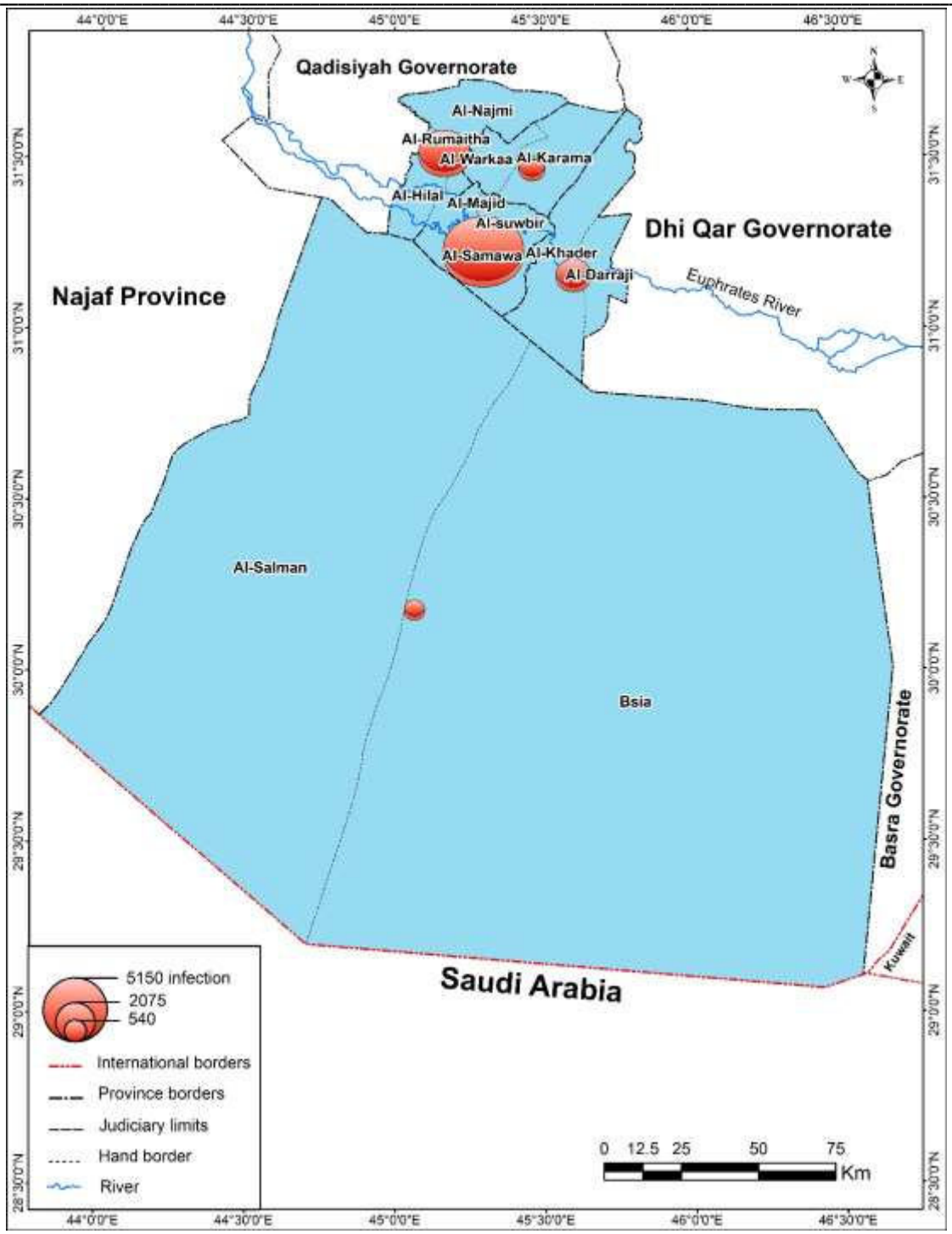


**Figure 5**: **Map Spatial Distribution of Covid-19 in Al-Muthanna (2020)** (Source : the data of Table 4) using Arc GIS10.6)

**11.2 Central Feature:** this tool identifies the feature or the located place which is the nearest to the distribution center of the feature individuals in progress. The central feature refers to a specific value lies in the mid of cases distribution. It is the virtual or ideal position to the central point of Covid-19 cases [20].

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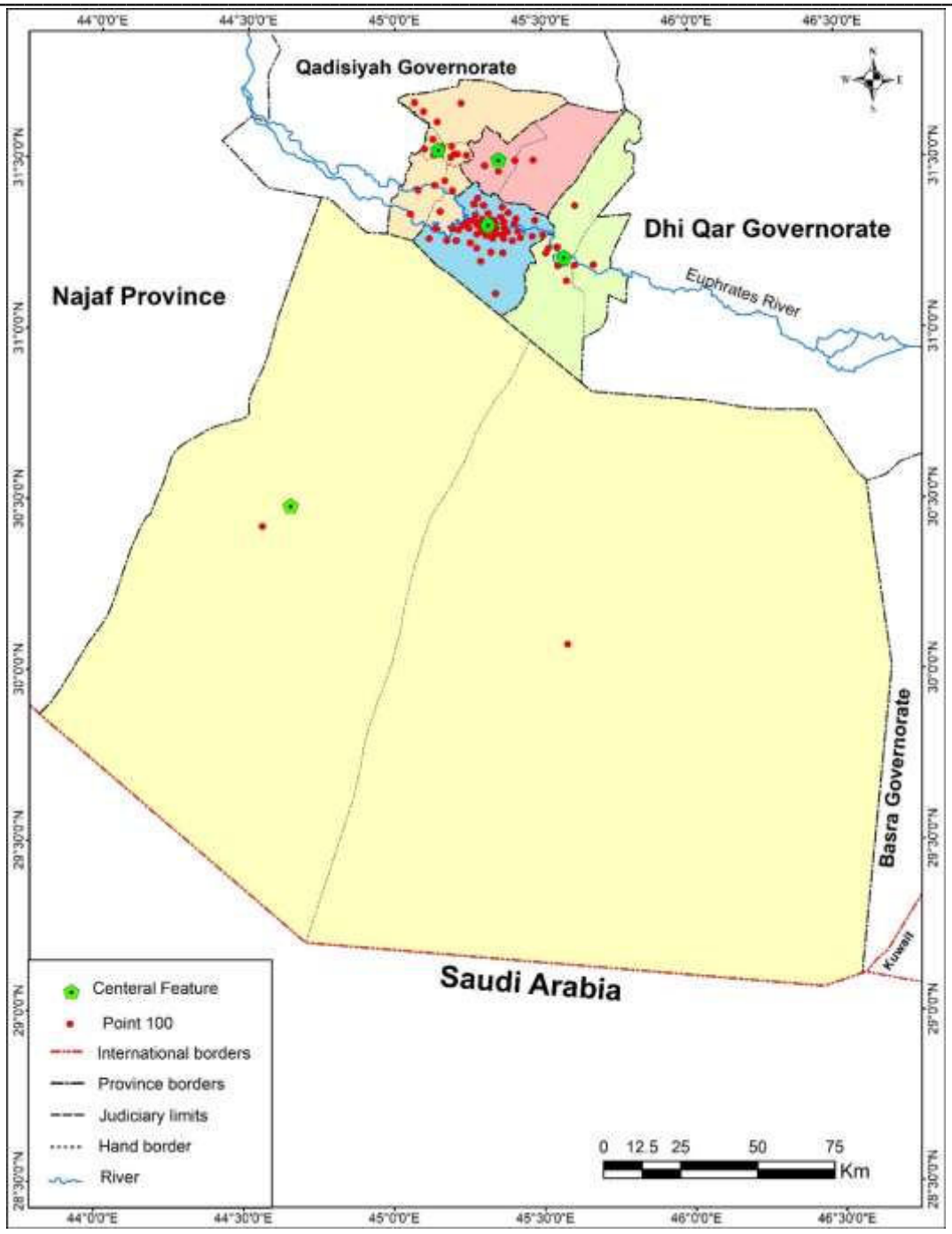


**Figure 6**: **MapThe central feature of Covid-19 cases in 2020 in Al-Muthanna according to the administrative units (**Source : the data of Table (5) using Arc GIS10.6)

**11.3 Mean Center:**

It is a basic demand to know the mean center in analyzing plenty of spatial distribution. Mean center helps in knowing the comparison between the actual center and ideal one. Through it, we can recognize the mean position to be the distribution center ,expressed as Center of concentration [5]. It is known as center of disease concentration and the purpose of it, in most studies, is to know the average for the points. It is the location which represents the central position among the points where the total points away from it should be less than any other location on the map . Since using this scale is to represent the spatial concentration center, different iterative values should be provided from another place according to the numeric value of the number of phenomenon in a particular place. By that, each point will carry its actual weigh for the weighted spatial mass center[15]. By applying this scale, as in (Figure. 7)., it is shown that the spatial mean center is in the upper mid part. This means in the northern part of Al-Muthanna specifically in a central position of Al-Samawah that represents the main attraction point of the population i.e. the point where

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people are evenly distributed in all of the governorate directions. In addition, it has institutions and medical stations which are lacked in other units, and it represents the heart of the spatial distribution. The virtual or optimal locations of the central point of covid-19 cases in each administrative unit of Al-Muthanna : in Rumaitha, the central geographical point lies within 28.89 km to the concentration or mean point on its northwest. For Al-Khudhir, it lies on its southwest within 25.88km. In Uruk, it lies on its northwest within 22.24km. The central point of Al-Salman lies on its southwest within 113.21km away from the mean point.

Concerning the representation of Covid-19 cases recorded as points in Al-Muthanna, it would be difficult to represent all the cases recorded in the province on map. It is necessary to choose quantitative mean to the cases with points. The number of points which represents the feature and its meaning should be known[11]. The number of corona cases recorded in Al-Samawah reached (51.5) cases. Rumaitha has reached (20.7) cases. The quantitative mean has been chosen to the point that each point represents (100 cases) . So, instead of drawing (5150)points for Al-Samawah, there will be (5150÷100=51.5 points ) which means the actual distribution is divided by (100) least value, as shown in table (5) and (Figure. 7,8).

**Table 5: Quantitative mean of Covid-19 cases represented by points in Al-Muthanna according to the administrative units 2020**

| Administrative Units | 2020 | |
|---|---|---|
| Samawah | 5150 | 51.5 |
| Rumaitha | 2075 | 20.7 |
| Khudhir | 949 | 9.5 |
| Uruk | 540 | 5.4 |
| Al-Salman | 324 | 3.2 |
| Total | 9038 | 90.4 |
| Points Number | Each point represents 5 cases | Each point represents 100 cases |

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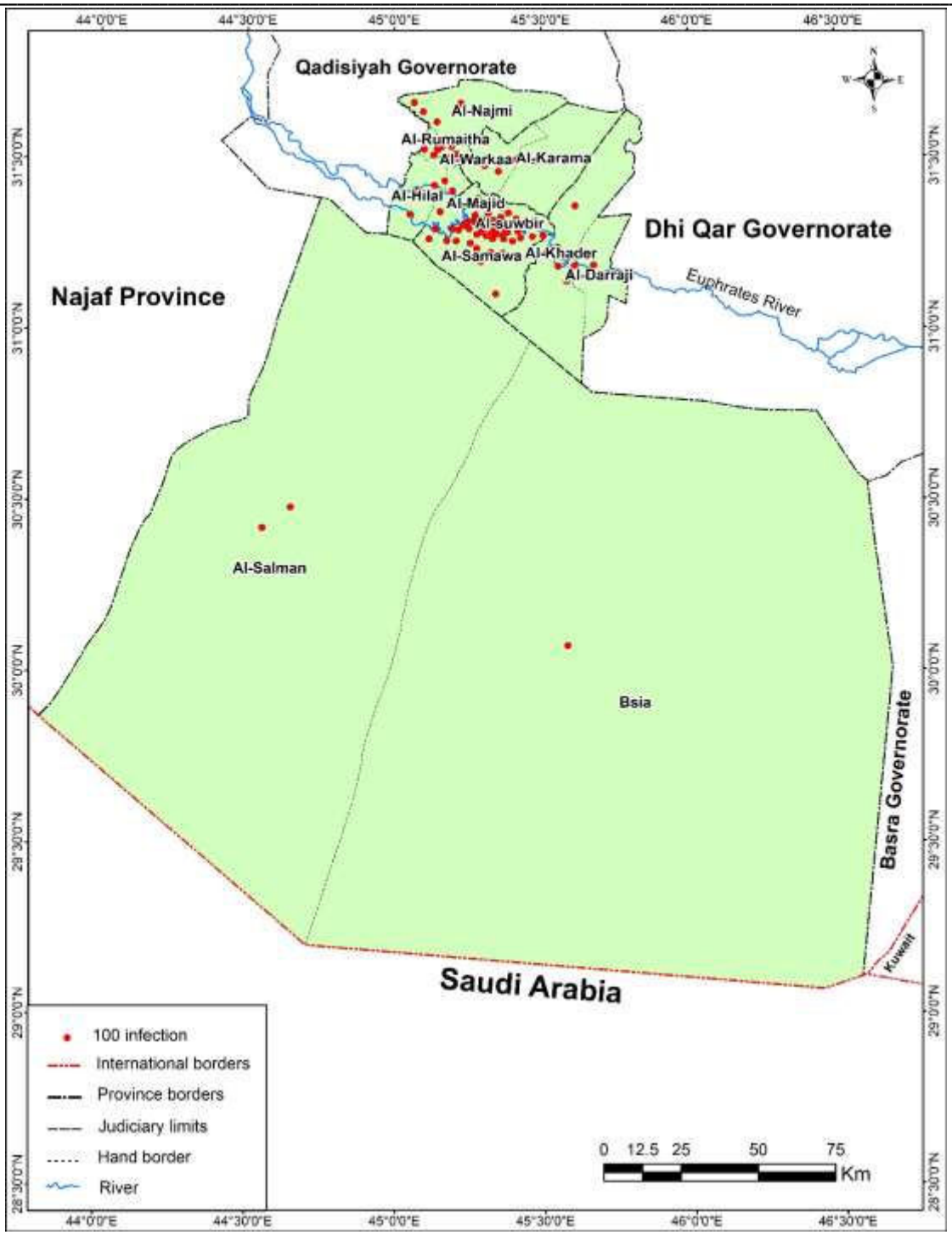


**Figure 7**: **Map the actual distribution of Covid-19 cases 2020 in Al-Muthanna province according to the administrative units (**Source : the data of Table 5) using Arc GIS10.6)

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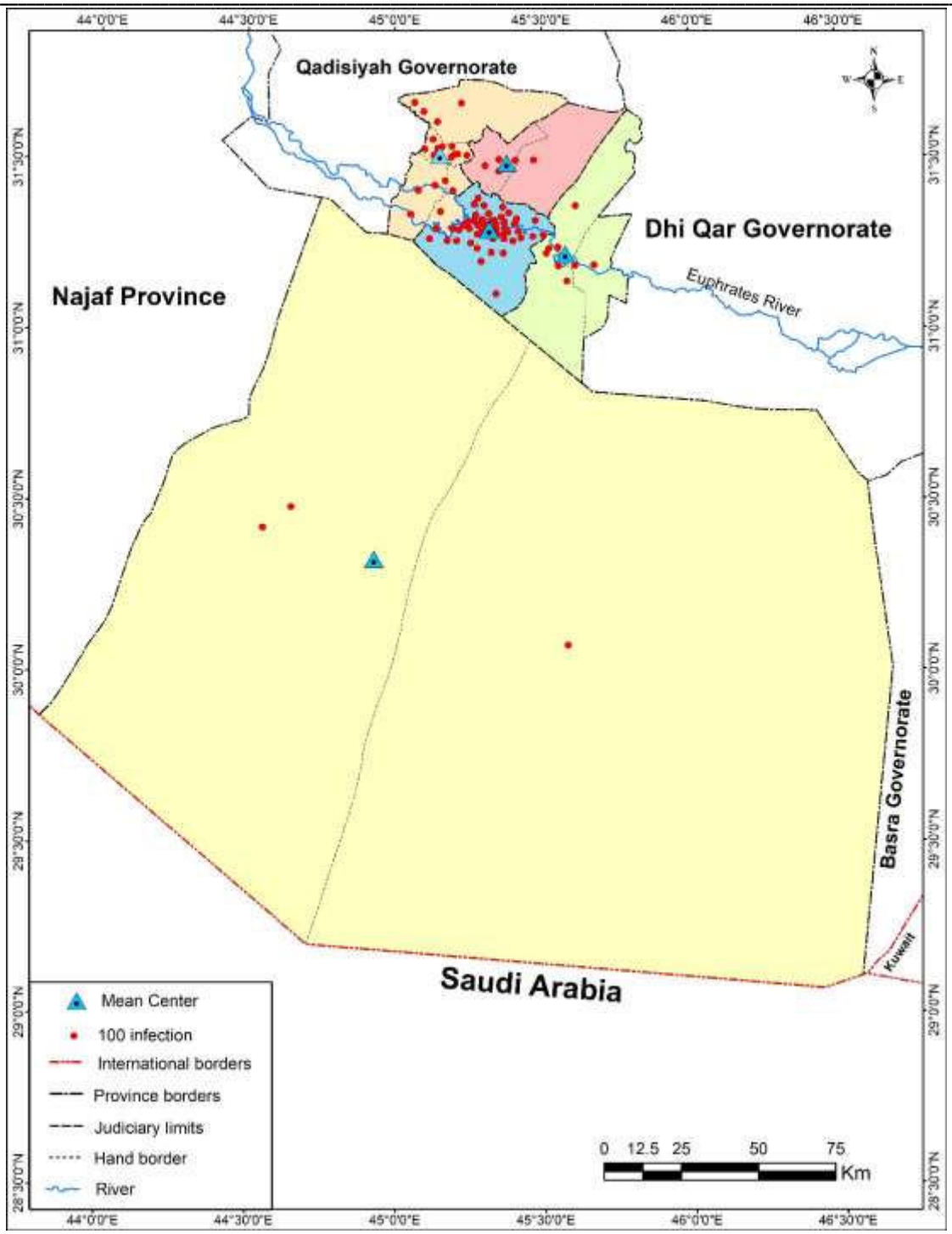


**Figure 8**: **Map mean center location (spatial potential center) of Covid-19 cases 2020 in Al-Muthanna governorate according to the administrative units** (Source : the data of Table 5) using Arc GIS10.6)

### 11.4 Average Nearest Neighbor

This model is used as one of the statistic tests to determine the spatial distribution patterns of the geographical phenomena, through using a mathematical method based on measuring the distance between each point and the nearest neighbor point. In other words, the analysis of the real or actual distance which separates the centers distributed on the map on points shape, and their rate to the rate of the excepted points separating the points in random distribution pattern[1] . The aim is to get an evidence to determine the geographical distribution pattern of Covid-19 cases in population's pattern whether it is (Clustered, Random, and Uniformed). Detecting the geographical distribution pattern of the endemic can help us recognize the effective variations in forming this pattern. The patterns that are shown by this test vary among the clustered pattern of (0-0, 67) value, convergent pattered (0, 68 – 0, 99), dispersed pattern (1-1, 99), and uniformed

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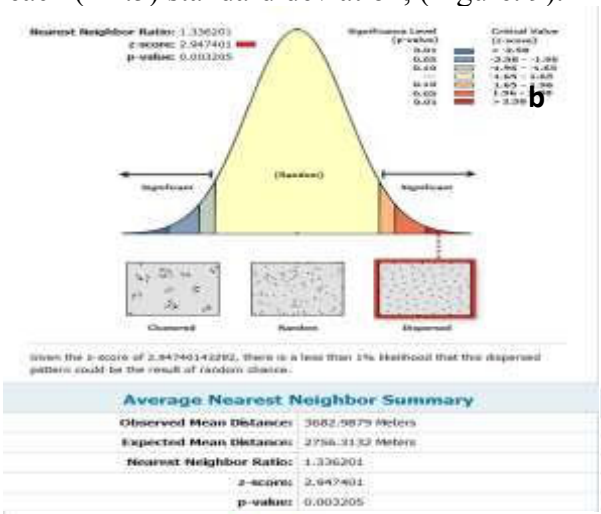
pattern (2-2, 5). If the calculated average was less than the expected one for such number of locations in the same geographical area (Random Distribution). The pattern of the endemic would be clustered. Whereas if the calculated distance was larger than the expected distance of a potential random distribution. The geographical distribution for locations or places of disease or population would be dispersed. So, the nearest neighbor can be expressed by calculating the ratio between the calculated distances divided by the expected one. If nearest neighbor is less than (1) Integer, the geographical distribution of Covid-19 is clustered, while if it is more than (1) Integer , the distribution is dispersed[6] .

Using nearest neighbor technology, we concluded that Covid-19 distribution pattern in Al-Muthanna is dispersed or geometrically irregular (Near to randomness) and does not submit to a specific system with less than 95% significance level in all administrative units of the governorate. This means that there is less than 1% possibility that this distribution is coincidence. This is because some residential neighborhoods are highly populated, and others are of wide areas.

It has been shown that the nearest neighbor ratio of the distribution resulted from the division of calculated distance average between the disease phenomenon locations and the expected distance for this type of disease number on the area of the same land recorded value (1.2) in Al-Samawa and Z value was (3.6) standard deviation which is more than (1) integer. This means that its distribution is dispersed. Moreover, in Rumaitha, the distribution is dispersed as well. It reached (1.3) value and Z was (2.9) standard deviation. Al-Khudhir is with dispersed distribution pattern with value reached (1.6) and Z was (3.9) standard deviation. As for Uruk the dispersed pattern is dominant with (2.8) and Z was (7.8) standard deviation. In Al-Salman, the average of nearest neighbor was the result of the calculated average divided by the expected average of Covid-19 which is (4.4), that means the dispersed pattern is dominant where Z value increao reach ( 11.5) standard deviation, (Figure. 9).

a

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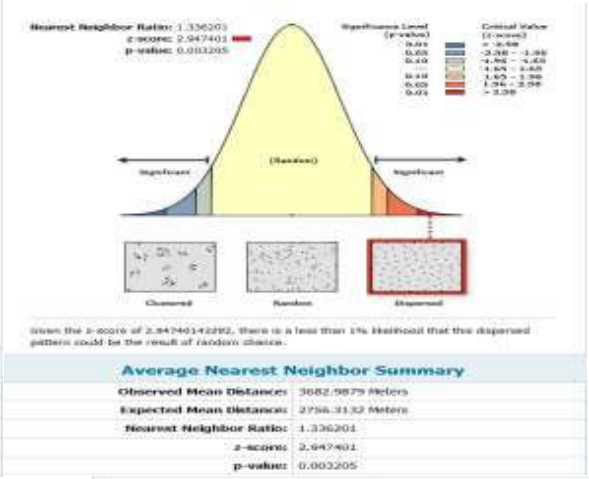


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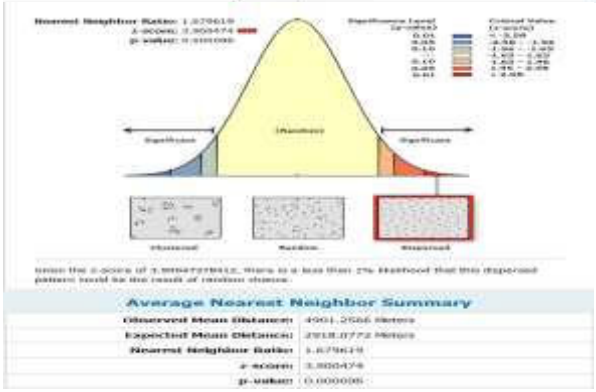


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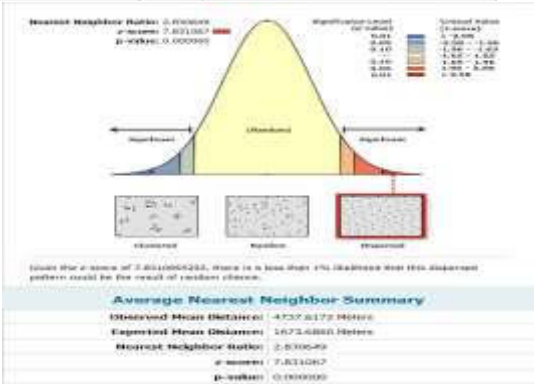

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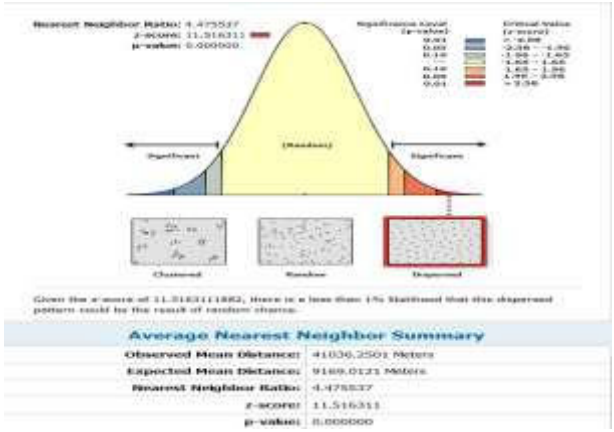


a. Al-Samawa
b. Rumaitha
c. Al-Khudhir
d. Uruk
e. Al-Salman

e

**Figure 9**: **Average Nearest Neighbor**

**11.5 Distance Standard**

Several Scales are used to study the distribution around center. Distance standard is one of these scales which is one of the dispersion scales and mostly used for measuring the distribution of infections around its middle center as it is the corresponding in the spatial statistics of the standard deviation to distribute the variable readings around its average[21]. Through applying the distance standard analysis on the the administrative units in Al—Muthanna using (Arc GIS10.6). From (Figure. 10) and (Table 6), it was shown that there were some administrative units with extensive Covid-19 cases and others with uncertain distributed cases. So, the center of concentration was determined which represent the mean center to distribute the infected cases (Optimal Center). Through applying Arc GIS10.6 technology, they were represented graphically on the map by drawing a distance standard circle to each administrative unit with its subordinate centroid. The results show that the spatial distribution of Covid-19 in the administrative units, Al-Samawah, Uruk , Al-Khudhir, and Rumaitha, tends to be excessive around their centroid. The radius of circle, which represent the standard distance for each, has reached (8965.10 m, 5595.72m, 7865.46m, and 11058.02m) radius respectively around the center of concentration, except Al-Salman where the spatial distribution of the infection tends to dispersion with (48863.29m). This is due to the nature of the area of Al-Salman which is wide, desert and with low population density. As can be seen, the spatial distribution pattern in most of Al-Muthanna administrative units is centered around the central point of concentration i.e. the direction of the covid-19 cases headed from the southeast to the northwest along the side of Euphrates river and as a result of (urbanization) the geographical extend of the governorate in the northwest.

**Table 6: Standard Distance & Circle Standard Distance of Covid19 distribution 2020 in Al-Muthanna governorate**

| Administrative Unit | Cases | Standard Distance |
|---|---|---|
| Al-Samawah | 5150 | 8965.10 |
| Rumaitha | 2075 | 11058.02 |
| Khudhir | 949 | 7865.46 |
| Uruk | 540 | 5595.72 |
| Al-Salman | 324 | 48863.29 |

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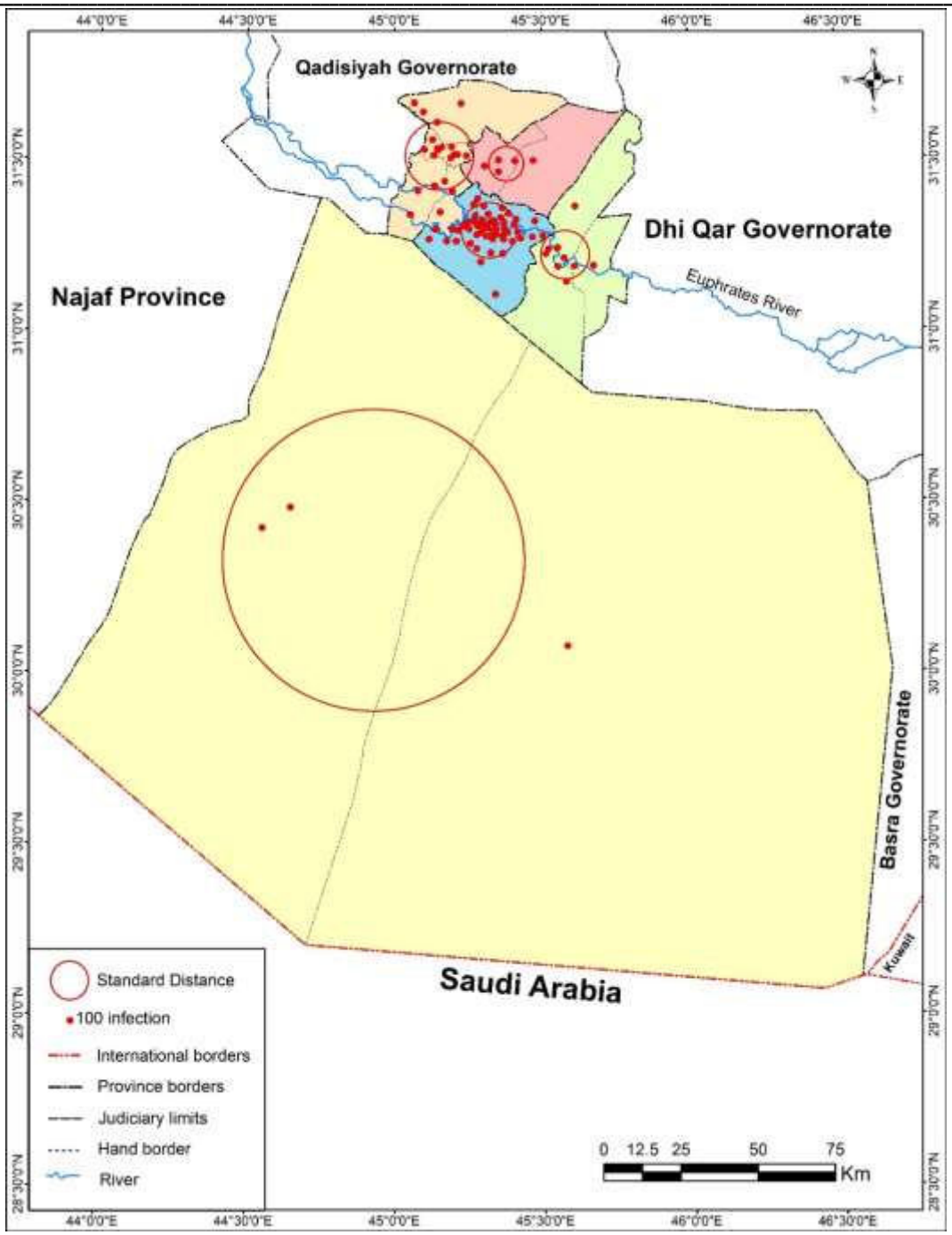


**Figure: 10 Map Standard Distance Covid19 cases 2020 in Al-Muthanna governorate in terms of Administrative Units (**Source : the data of Table 6) using Arc GIS10.6**)**

**11.6 The distributional Direction**

The distributional direction is one of the spatial properties. It is the corner unit which represents the size of the gap that appears when two action lines meet, or when a line splits into several directions. The direction is a relative measure. The standard deviation and distribution direction are used to determine the geographical representation area (Covid-19 cases) and recognize how far they spread to the geographical directions (North, South, East, West) in Al-Muthanna. Most of time ,the geographical phenomena distributions do not equal in their spread directions, but take different directions and the general direction corner is measured around its mean center[18] .

(Figure. 11) shows the actual distributional direction (Standard deviation) of Covid-19 distribution pattern in Al-Muthanna in terms of the administrative units. It takes an ovular shape and moves from southeast to northwest in (Al-Samawah, Al-Rumaitha, Al-Khudhir) through the value of the angle rotation calculated of the active spreading. It goes clockwise reaching (89.72392, 3.5073, and 178.19102)

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respectively along Euphrates river side, except Al-Salman where the direction of the infection cases was from southwest to northeast which goes counterclockwise. This is what the counted angle confirms (113.548239) and it is in the direction of Al-Samawah, Al-Khudhir. Uruk had a different direction that moved from North to West in (81.482523°). As it can be seen, we conclude that the direction of the infection distribution in the administrative units is linked to the population and urban sprawl Urbanization which have been experienced by the administrative units of Al-Muthanna in the stated directions.

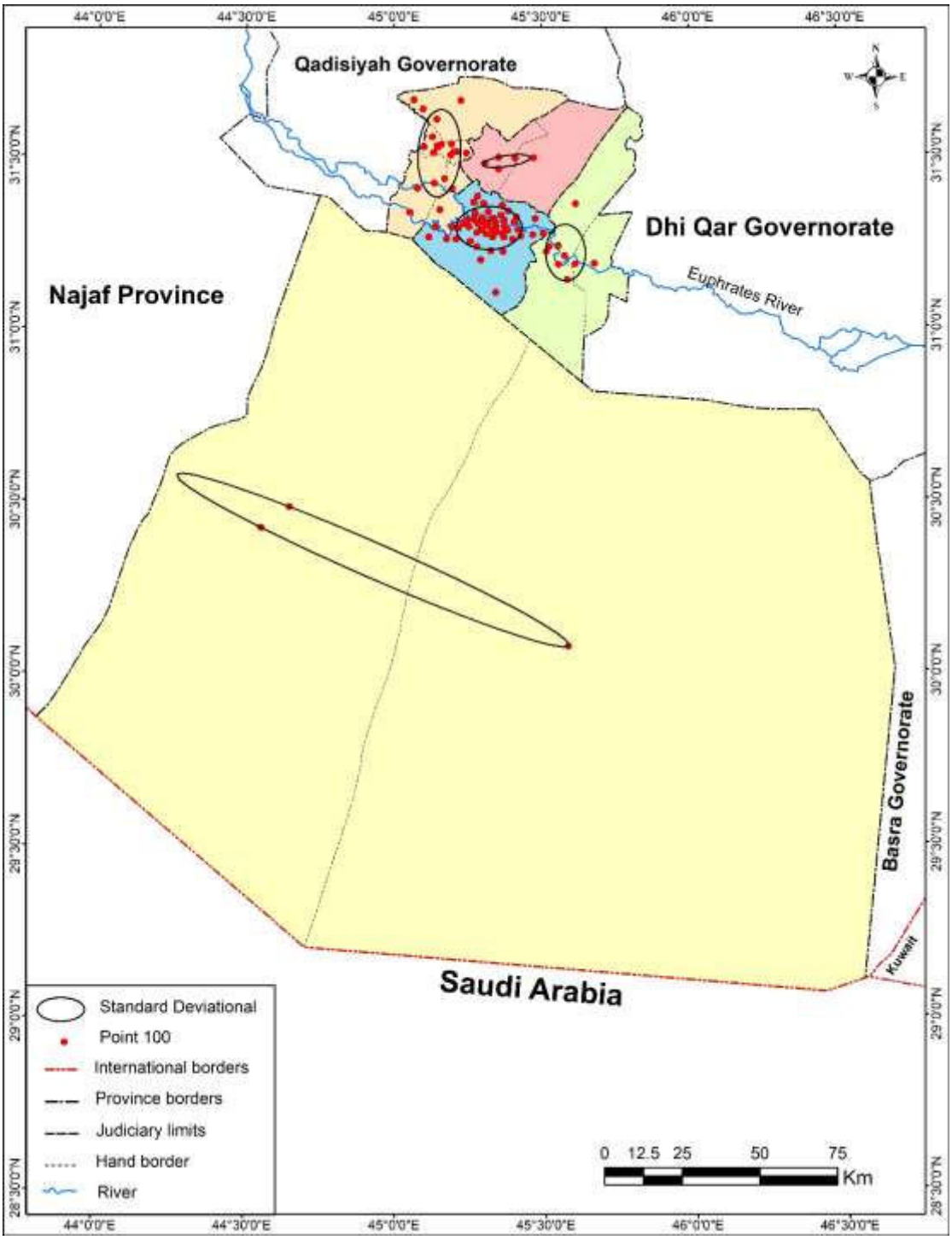


**Figure: 11 Map Covid-19 positive cases 2020 in Al-Muthanna according to the administrative units** (Source : the data of Table (5) using Arc GIS10.6)

**12 Conclusion:**

1. The prevalence of Covid-19 in Al-Muthanna population reached the highest in Al-Salman (277.9) per 10.000, while in Uruk ,it reached (51.3) as the lowest.

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2. The study proved that there is a spatial disparity in terms of the numerical and relative distribution of Covid-19 cases in the districts and sub-district centers. It was clear that district center Al-Samawah was in the top of the administrative units with (56.9%) rate, whereas the least rate is the one of district centers of Uruk & Al-Salman which reached (5.9, 3.5 %) respectively.
3. Corona virus hit all the age groups in the governorate with variable proportions and this is due to the age composition. It has been recognized that Covid-19 cases of age group (20-44) is the highest one in comparison with other age groups. This one reached the top by 5465 cases and 60.4%. Whereas the least is the one of (less than a year) which recorded 18 cases which is 0.2%. The statistics detected that male's cases are more than female cases. Males reported cases reached 4469, which is 64% of the overall cases, while females reported cases reached 2469, which is 35.9% of the overall cases.
4- The mean Center concentration of all administrative units in the upper part or the northern part of the governorate approaching to the river sides, specifically in a central location in Al-Samawah, which represents the main attraction point to all distributions. This means that the population concentration lies there and that is why the prevalence of Covid-19 cases increases.
5. Through using Average Nearest Neighbor technology, it was concluded that the distribution pattern of Covid-19, in Al-Muthanna, is dispersed and geometrically unorganized (close to be random).
6. By applying the standard distance scale, the outcomes showed that the spatial distribution of Covid-19 cases in the administrative units Al-Samawah, Uruk, D.C Khudhir, Rumaitha tends to be concentrated around its mean center. The radius of a circle representing the standard distance for each of them reached (8965.10 m, 5595.72 m, 7865.46m, 11058.02m) respectively around the central point of attraction, except Al-Salman where the spatial distribution tends to dispersed with a radius reached (48863.29m).
7. After using the directional distribution or spread tool represented by an ovular shape, the actual direction of Covid-19 cases in Al-Muthanna according to the administrative units appears to take an ovular shape. It moves from southeast to northwest in all of Al-Samawah, Rumaitha, Khudhir through the value of the calculated angle rotation for the active spread direction which is clockwise reaching (89.72392, 3.5073, 178.19102) respectively and parallel to Euphrates stream, except Al-Salman where the direction of the infected cases was from southwest to northeast which goes counterclockwise. This is confirmed by the calculated angle (113.548239).
8. The capabilities of GIS are shown through applying the methodology of Covid-19 spatial analysis in Al-Muthanna according to the administrative units by using spatial analysis tools.

**Recommendations**

From the results of the study, the following recommendations can be set:

1. Adopting geographic information systems (GIS) technology in studying and analyzing the geographical distribution of geographical phenomena in general, and the distribution of diseases in particular.

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**Declaration**

Declaration Conflict of interest The authors declare no conflicts of interest

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